

Hun (E. R.)

THE

TRICHINA SPIRALIS.

BY

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*Presently
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TRICHINA SPIRALIS.

The *Trichina Spiralis* is a round worm belonging to the class of *Nematoidea*, and is found as a parasite affecting man and certain animals.

It was first found in human muscles by Mr. Hilton in 1832, and three years later was described by Professor Owen, who gave to it the name of *Trichina Spiralis*, from its slender form and habit of coiling itself up in a spiral shape. From this time, until 1860, the *Trichina* was frequently observed in the muscles of subjects in the dissecting room, but no account was given, and no theory formed as to how it got there. In all these cases the worm was found enclosed in a calcareous cyst.

Zenker of Dresden, in 1860, first called public attention to the fact that these little parasites, hitherto considered harmless, might be, and often were, the cause of severe and fatal diseases. A farmer, his wife and several other persons were attacked with a severe illness after eating of the flesh of a pig raised and slaughtered on their farm near Dresden — a servant who had eaten some of the meat died. Zenker, upon examination, found *Trichinæ* in the ham, head cheese and sausages made from the pork, and the muscles of the dead girl were filled with them. He sent some of the muscle to Professor Virchow of Berlin, who, by a series of experiments upon animals, developed the following interesting facts:

The *Trichina*, as found free in the muscles, is a round worm about one-twenty-fifth of an inch in length, rather more pointed at its cephalic than at its caudal extremity.

A digestive canal runs the whole length of the animal, and at its posterior part is a closed sac running about one-third of its whole length and filled with granular matter.

No sexual organs are to be seen.

If portions of this muscle are introduced into the stomach of certain animals (as rabbits for example), and these animals are killed and examined at different intervals, we find that the Trichina passes through the following stages of development.

During the three days following its ingestion it grows rapidly in size, becoming from three to four times its original length. At the same time sexual organs are developed, and the closed sac, mentioned above as occupying the posterior portion of the body, becomes ovaries in the female and testicles in the male, and within from eight to ten days from the time of their entrance into the stomach each female Trichina gives birth to living young whose number has been estimated at from two hundred to one thousand from each parent. Whether the same individual becomes pregnant more than once, is not yet fully determined, but from some of the facts observed it is probable that they do. The young Trichinæ are exceedingly minute and thread-like, and commence immediately after birth to bore through the walls of the stomach and intestines containing them, and disseminate themselves with wonderful rapidity all through the muscular tissue. It is a curious fact that they are found to locate themselves only in the tissue of those muscles which are under the control of the will, never having been found in the heart or muscles of organic life. After reaching their destination in the muscle they increase gradually in size until they attain one-twenty-fifth of an inch in length, and then coil up in a spiral form and remain quiet in the midst of the deposit of fibrinous matter, which the irritation of their presence has caused to be deposited around them by the vessels supplying nutriment to the

part. This afterwards contracts, enclosing each worm in a separate sac, which is finally in its turn enveloped by a deposit of calcareous matter. The Trichina now remains quiescent in his shell for an indefinite period of time, waiting until some unfortunate animal shall receive him into his stomach, when the acid contained in the gastric juice dissolves the walls of his prison house, and sets him free to give birth to a new generation, who go through a similar cycle of existence, while the parent worm dies and passes off with the intestinal evacuations. It follows from the above observations that the Trichinæ have four distinct phases of existence:

- 1st. The Trichinæ, when swallowed, stop in the intestine, complete their development there, give birth to young, and then die.
- 2d. The little Trichinæ, as soon as born, migrate into all the striated muscles, except those of the heart.
- 3d. Having reached the muscular system they increase in size but not in number.
- 4th. They become encysted and remain quiescent until eaten by man, or certain animals, when they in turn give birth to a new generation, after which they die.

The symptoms produced by this parasite vary according to the number swallowed and to their different locations in the body, and the disease called Trichinosis may be divided into three stages: 1st. The period of a intestinal irritation. 2d. The period of muscular irritation; and 3d. That of convalescence or termination.

The severity of the symptoms of course vary greatly in different cases. Sometimes the intestinal irritation is so slight as to pass unnoticed by the patient, while, on the contrary, it at other times results in diarrhoea with bloody discharges, with severe abdominal pain, and more rarely in constipation. The tongue is ordinarily dirty and coated. There is nausea, with mucous or bilious vomiting, tumefac-

tion of the abdomen, and in severe cases painful colics. The pulse is always rapid, and the skin hot. The patient hardly ever dies during this stage of the disease. The second period of muscular irritation is always present, unless the number of *Trichinæ* ingested is very small. When we consider that each female gives birth to four hundred or five hundred young at least, we can understand how a few mouthfuls of the infected meat may give rise to millions of little worms, each of which bores its way all over the body of the patient. This period usually lasts from four to five weeks, and commences with languor and chills, followed by pains in the limbs, and a puffy swelling of the eye-lids and face, which is scarcely ever absent. This swelling often attacks the upper and lower limbs as well as the face. The muscular pains are very acute, and the slightest motion or pressure produces extreme agony. The tongue becomes swollen and painful, and the pulse rises from 115 to 130 per minute, while the diarrhœa often continues, and the abdomen is tumid and tender. Sleep is almost entirely destroyed, and the thirst becomes very urgent. There is often a troublesome cough, which increases the pain and soreness. During this period the patient, if he is able to walk at all, does so upon his toes, as if unable to put his heel to the ground. These symptoms usually abate after from the twentieth to the fortieth day, but the patient remains worn out and exhausted, and the third period, or that of convalescence, is usually long.

Unfortunately all cases do not reach the stage of convalescence. Death often takes place during the second period, or at the commencement of the third, and the patients die with symptoms resembling those of a severe case of typhoid fever.

Thus far it has always been observed that *Trichinosis* in man has resulted from eating pork, but the hog is not the only animal in which this parasite has been found

to exist. Among the animals in which *Trichinæ* are found without the intervention of human agency, are: the hog, cat, rat and mouse, mole, badger, etc.; and of birds, the owl, crow, raven, hawk, etc. Besides these, it is found that the administration of diseased meat will produce the *Trichinæ* in the Guinea-pig and rabbit, and the chicken and pigeon. It has been found impossible to trichinose beef, horse, ass, mutton, etc., or the goose, duck or turkey. Experiments have also been tried on fishes, but with a negative result. It is by no means probable that Trichinosis is so rare a disease as it is commonly supposed to be.

It is not an easy disease to detect, because it has no pathognomonic symptoms. During the first period the symptoms might easily be mistaken for those of dysentery while during the second stage the œdema of the face and limbs greatly resemble the early stages of Bright's disease of the kidneys, and the muscular pains are not unlike some severe cases of rheumatism. The third period has, according to Virchow, been mistaken for consumption. The epidemic of Trichinosis which occurred at Hettstadt was at first considered to be choleric, while that at Magdebourg was for some time called by a false name.

In a medico-legal point of view, this disease presents points of great interest. The following case will give a just idea of its importance;

In February, 1865, Langenbek operated upon a man at Berlin for a tumor of the neck. During the operation, he remarked that the muscles were filled with encysted trichinæ. Upon asking this man if he had ever had any previous illness, he stated that in 1845, he had with others inspected the schools at Jessen; that eight of them had breakfasted together upon ham, sausage and white wine, with the exception of one who only took a glass of red wine. All the other seven, including the man who had

been operated upon, fell sick, and four of them died. Suspicion naturally fell upon the innkeeper, and an investigation was made without result. Nevertheless the innkeeper continued to be suspected of having poisoned his guests, and he was obliged to emigrate to America. The mortality of this disease is not so great as is usually estimated, as is shown by the following statistics taken from some of the epidemics. At Plauen, two deaths out of fifty cases. At Calbe, seven out of thirty-eight. At Hettstadt, twenty-seven out of one hundred and fifty-eight; and at Bourg, eleven out of fifty.

Virchow arranges the measures to be taken in order to prevent the propagation of the *Trichinæ* under three heads: 1st. *Preventing as far as possible the infection of swine by Trichinæ*. This can only be done by close attention to their food and cleanliness, for, since we cannot admit the spontaneous generation of *Trichinæ* in the pork, their presence necessarily presupposes that infected meat must have been taken into the stomach of each diseased hog. 2d. *The meat should be carefully inspected before being delivered to the consumer*. This can only be done properly by means of the microscope; for, to the naked eye, the diseased meat offers no abnormal appearance, except in cases where the parasites have existed in the muscles for a long time, and are surrounded in a thick cyst of calcareous matter, when they may be seen upon careful examination as little white specks. 3d. *Before being placed upon the table, pork should be thoroughly cooked*. It is not an uncommon habit among certain classes to eat the pork raw, in which case the greatest danger, of course, threatens the consumer. But even after cooking or smoking, the central part of a large piece of pork, often does not reach a sufficiently high degree of temperature to destroy the vitality of the *Trichinæ*, and as now-a-days hams are often sold as smoked which have simply been rubbed over with creasote, pyroligneous acid

or some other empyreumatic substance, we find that eating cooked pork is not entirely devoid of danger. It has, however, been shown by Virchow that a temperature of 210°, or a warm fumigation of twenty-four hours duration, infallibly destroys the *Trichinæ*.

I have given this short account of the *Trichina* this evening, thinking that it might be of interest to the members of the Institute, and especially because I have met with two cases of this disease in this city. I was invited by Dr. C. D. Mosher to see two of his patients, one of whom was evidently dangerously sick, and yet presented a train of symptoms which did not conform to any of the ordinary diseases which prevail in this locality. Two boys of German parentage came into the house hungry one morning, and finding a piece of pork upon the table ate some of it raw. The remainder was cooked and eaten by the family at dinner time. A few days afterward the elder boy, aged fourteen years, became sick and vomited several times. Was feverish, and his eye-lids and face were swollen. Then a general soreness attacked his whole body and limbs, which confined him to the bed for a few days, after which it gradually abated, so that when I saw him some six weeks afterward he was quite well, except slight soreness on pressure about the muscles of the arms. The younger boy, aged ten years, was not so fortunate. He, too, became sick a few days after eating the pork. His face and limbs became swollen, and he was attacked with a severe diarrhœa. The muscular soreness became intense, and he walked on his toes with the heels off the ground for three weeks, after which he was obliged to lie still in bed, the least motion causing extreme pain. About this time a troublesome cough commenced, and the effort of coughing increased the soreness. He could not sit up, but remained stiff and extended upon his back. The least pressure

upon the limbs caused him to cry out in agony. This was his condition when I saw him last.

By means of a small instrument, which I had constructed for the purpose, I removed a little piece of muscle from the shoulder of the eldest boy, which I have examined under the microscope, and find studded with trichinæ which are coiled up and quiescent, preparatory to becoming encysted. The younger boy was so tender to the touch that I was unwilling to submit him to the pain of the operation.

NOTE.—Since the above paper was read before the Institute, the younger boy has died, and a microscopic examination of the muscles showed them to be everywhere filled with Trichinæ, in some of them enveloped in a newly formed cyst, and others free and full of life and motion. In order to give some idea of their number I may state that I counted forty-one trichinæ in a single field presented by a lens of one-inch focal distance.